

**Beyond Pareto Optimality:
The Necessity of Interpersonal Cardinal Utilities in
Distributional Judgements and Social Choice**

By

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I. Introduction

The New Welfare Economics is associated with the attempt to rid social welfare judgments of interpersonal comparisons of utility¹. However, the term “New” is misleading by today’s standard. It is true that perhaps the majority of economists still scorn the glaring interpersonal comparisons of the Old Welfare Economists of the Edgeworth and Pigou vintage as mixing “value judgments” with scientific analysis². But those who work in the field of social choice have increasingly realized that interpersonal comparison of *cardinal* utility is inevitable if some reasonable social choice is to be made, even if we go along with the questionable rejection (Little, 1952; Samuelson, 1967) of Arrow’s (1951, 1963) inter-profile framework admitting *alternative* sets of individual preferences, and confine welfare economics to a single set of individual preferences (Kemp and Ng, 1976, Parks 1976, Hammond 1976, Roberts, 1980 a, 1980 b, 1980 c). More generally, first-class economists now freely use frameworks with interpersonal cardinal utilities in their anal-

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¹ I abstract from possible differences between individual utility (or preference) and welfare, on which see Ng (1979, Section 1.3).

² For the argument that interpersonal comparisons of utility are not value judgments but subjective judgments of fact, see Ng (1972, 1979, Appendix 1A).

ysis (e. g. Mirrlees, 1971, forthcoming). There seems to be a revival of classicism in welfare economics, but classicism reaching a new height, just as there is a revival of classicism in macroeconomics with emphasis on the long-run neutrality of money, rational expectation, and microeconomic foundation. In this paper, I attempt to extend this revival of classicism in welfare economics emphasising the role of interpersonal comparisons of cardinal utility (not just of utility levels, but also of utility differences or unit comparability).

I shall start from the question of distributional judgments before coming to social choice in general. Where two social states differ from each other in and only in distribution (of income, of specific goods or some other objective factors among individuals)³, can we rank them according to some distributional judgment based on some objective factors (such as equality) irrespective of individual preferences? It is almost trivial that, if we accept the (even just weak) Pareto Principle⁴, the answer is negative (Proposition 1). This proposition is not worth stating but for the popular tendency to ignore it. What about the reverse possibility: Can we make distributional judgements about points in the space of individual utilities irrespective of what social states they represent? Such abstract distributional judgments are very tempting (as shown below, some prominent economists have been tempted), given the Pareto-inconsistency of non-individualistic distributional judgments. However, Proposition 2 shows that they are again inconsistent with the Weak Pareto Principle in general. Taken together, Propositions 1 and 2 show that reasonable distributional judgments must consider individual preferences under alternative social states, i. e. both the subjective and objective factors (and their relationships) must be taken into account. But can we manage with just *ordinal* individual preferences? Secondly, Propositions 1 and 2 are proved by using some "extreme" examples; what if we adopt standard economic assumptions about individual preferences (self-interest, convexity, non-satiation)? Proposition 3 establishes the impossibility of non-cardinalistic distributional judgments under standard economic assumptions, roughly speaking. Proposition 4 generalizes Proposition 3 to any social choice (not necessarily distributional), establishing the impossibility of non-cardinalistic ranking rules under mild condi-

³ By "differing in and only in distribution", we do not exclude differences (e. g. the costs of redistribution) incidental to or caused by distribution, but changes or differences unrelated to distribution are ruled out.

⁴ Many rejections of the principle are based on misunderstanding (see Ng, 1979, Section 2.1) while Sen's (1979) query is answered in Ng (1981).

tions (mainly the Pareto Principle and Anonymity), without assuming neutrality.

After proving the above four propositions (Section II), Section III discusses their implications and how they are violated (at least in spirit) in the literature, by discussing in turn Mishan's (1973, 1976) proposed resolution of the paradox of welfare criteria, Sen's (1973) concept of the Weak Equity Axiom and some more recent concepts of fairness and equity. These criteria of equity are free of interpersonal cardinal utilities but are shown to be inconsistent with the weak Pareto principle. This is followed by a general discussion of the impossibility of a Paretian X (Section III D) and some concluding remarks (Section IV).

II. Formal Analysis

Let us begin by adopting some definitions and notations.

Social Situations (denoted Q, S , etc.) and *Social States* (x, y, z): In a given social situation, all factors, except distribution and possibly those changes contingent on distribution, affecting individual utilities are being held constant. If distribution is also given, we have a social state. Different social states of a given social situation are due to and only to distributional changes.

Possibility of Distribution: For any social situation under consideration, there exists at least two alternative distributions (social states).

Since we are considering *distributional* judgments, the Possibility of Distribution must be admitted. Hence this condition is purely formal.

A *Distributional Judgment (DJ)* is a statement asserting that a social state or a point in the space of individual utilities (denoted a or b) is distributionally ideal, worst, or somewhere in between (e. g. good), or asserting that one is distributionally better than or indifferent to another.

A *Non-Individualistic Distributional Judgment (NIDJ)* is a DJ which is independent of individual preferences.

Abstract Distributional Judgments (ADJ) are DJ of points in the space of individual utilities irrespective of what social states they represent.

Unrestricted Preferences (UP): All logically consistent individual orderings of social states are admissible.

Unrestricted Society (US): All possible social states are admissible.

Unrestricted Domain (UD): Subsumes UP and US.

As usual, we use P^i , R^i , and I^i to denote the strong preference, weak preference, and indifference of individual i , and the ones without superscript to denote social preferences. In addition, we use D and E to denote distributional preference and equivalence respectively.

Weak Pareto Principle (WPP): For any two social states x and y (not necessarily of the same social situation), if $xP^i y$ for all i , we have xPy .

Weak Pareto Principle, as applied to distribution (WPP'): For any two social states x and y of a given social situation, if $xP^i y$ for all i , we have xDy .

This is a natural application of WPP since, by definition, different social states of a given social situation differ from each other only with respect to distribution.

A. *The Impossibility of Non-Individualistic Distributional Judgments*

We may now state and prove Proposition 1.

Proposition 1: Given Possibility of Distribution, Unrestricted Preference, and WPP', no Non-Individualistic Distributional Judgment (NIDJ) is possible.

Proof: By definition, a NIDJ of a single social state x states that x is distributionally ideal, worst, or somewhere in between, independent of individual preferences. From Possibility of Distribution, there exists social state(s) in Q other than x . If $yP^i x$ for all i and for all $y (\neq x)$ in Q , then x is distributionally inferior to all y in Q from WPP' and hence cannot be distributionally ideal or even "somewhere in between". If $xP^i y$ for all i and for all $y (\neq x)$ in Q , then x is distributionally superior to all y in Q and hence distributionally ideal in Q . It cannot therefore be distributionally worst or even "somewhere in between". It is thus impossible to judge the distributional desirability of any x in any Q independently of individual preferences. The impossibility of a NIDJ comparing two social states can be similarly established (cf. the proof of Proposition 2 below).

Q. E. D.

Proposition 1 is almost trivial. With Unrestricted Preference, distributional judgments that ignore individual preferences will in general conflict with WPP'. Recognising this, one may make individual utilities the central and only factor in making distributional judgments. Thus, one may make distributional judgments on points in the space of individual utilities irrespective of what social states they represent. Whether individual utilities are ordinal or cardinal, Proposition 2 shows that such DJ are inconsistent with WPP', given Unrestricted Domain.

B. The Impossibility of Abstract Distributional Judgments

Proposition 2: Given Unrestricted Domain and WPP', no Abstract Distributional Judgment (ADJ) can be made.

Proof: An ADJ may be either a judgment of a single point or a comparison of two points in the utility space. For a single point (called a), the judgment must mean that a is either distributionally ideal, worst, or somewhere in between, irrespective of what social state it represents. Consider a social situation Q with a social state x such that x corresponds to (is represented by) the point a in utility space and such that $xP^i y$ for all i and for all y in Q . From Unrestricted Domain this is possible. From WPP', x is distributionally superior to all social states in Q and hence distributionally ideal in Q . Thus, a , as representing x , is distributionally ideal. It cannot thus be worst or even somewhere in between. Consider another social situation S with a social state z corresponding to the point a in utility space. If $yP^i z$ for all i and all y in S , z is distributionally inferior to all social states in S and hence distributionally worst in S . Thus, a , as representing z , is distributionally worst. It cannot thus be ideal or even somewhere in between. Distributional judgments of a point in utility space irrespective of which social state it represents are thus impossible.

An ADJ comparing two (distinct) points must either mean aDb or aEb (bDa can be rewritten as aDb by redefinition of names). Consider a social situation Q' with a social state v corresponding to a , and a social situation S' with a social state w corresponding to b . Let $yP^i v$ for all y in Q' and $wP^i y$ for all y in S' . This is possible from Unrestricted Domain. From WPP', v is distributionally worst in Q' and w is distributionally ideal in S' . Thus we can have neither aDb nor aEb irrespective of what social states they represent.

Q. E. D.

C. The Impossibility of Non-Cardinalistic Distributional Judgments

Since we use somewhat extreme examples⁵ to rule out NIDJ (non-individualistic distributional judgments), it may be thought that, provided we are confined to conventional economic assumptions about individual preferences (non-satiation, convexity, self interest and no externalities), NIDJ may be all right, or, at least, that we may need only to take account of individual ordinal preferences, without having to handle interpersonal comparable cardinal utilities. However, I wish to rule out NCDJ (non-cardinalistic distributional judgments) even under the restriction of conventional economic assumptions. First, I shall show that the egalitarian ethics of distributive justice are inconsistent with the Weak Pareto Principle in a simple, conventional economic environment and later I shall discuss how this result can be generalized to rule out all NCDJ.

The *Naive Egalitarian Distributional Judgment (NEDJ)* states that a completely equal distribution of every distributable object (including each economic good) is the best distribution for any social situation.

That this NEDJ conflicts with the Pareto Principle is obvious. Unless tastes are virtually identical for all individuals (common marginal rates of substitution at the complete equality situation), some exchange from this complete equality will be Pareto superior. This glaring deficiency of NEDJ can be easily overcome in a pure exchange economy (but not so in an economy with production; cf. the possible non-existence of "fair" allocation discussed by Pazner and Schmeidler, 1974; and Varian, 1974) by a slight revision.

The *Pareto-Improved Egalitarian Distributive Judgment (PIEDJ)* states that, for any social situation, the best distribution is to distribute all distributable objects equally and let individuals engage in mutually advantageous exchanges.

This leaves the final allocation a little indeterminate except in the case of a unique set of exchange ratios as may prevail in a competitive economy of many individuals. We shall not worry about this minor indeterminacy. Instead, we wish to establish:

⁵ In the proofs of both Propositions 1 and 2, a single Pareto-optimal and/or Pareto-worst social state in a given social situation is postulated. Such examples may not be as extreme as they appear, taking account of costs of redistribution including disincentive effects and rent-seeking activities, see Friedman (1980).

Proposition 3: PIEDJ is in general inconsistent with WPP even if the domain of social choice is restricted to an exchange economy satisfying the conventional economic assumptions (non-satiation, convex preferences, self-interest with no externalities).

Proof: One example suffices to prove the proposition. For simplicity, consider a simple society of two individuals and only one economic good (which we call petrol; all other goods are free). Given the non-economic factors, each individual prefers more petrol to less. (With only a single distributable good, NEDJ and PIEDJ become equivalent). The non-economic factor that we shall consider here is the weather but could be anything else⁶. Suppose Jan prefers hot weather if she has enough petrol (7 units) to enable her to go swimming but would rather have cold weather with less petrol than enduring the heat without swimming. On the other hand, Kelvin prefers cold weather if he has enough petrol (7 units) to go skiing but would rather have hot weather with less petrol than watching the snow without being able to ski. Now consider the following four social states H^1 , H^2 , C^1 , and C^2 , each pair corresponding to two different distribution of the given 10 units of petrol in two social situations differentiated by hot and cold weather:

$$H^1 = (J=7, K=3, H)$$

$$H^2 = (J=5, K=5, H)$$

$$C^1 = (J=3, K=7, C)$$

$$C^2 = (J=5, K=5, C)$$

where $J=7$ indicates that Jan has 7 units of petrol, etc.⁷. Since H^1 and H^2 differ from each other only in the distribution of petrol, PIEDJ dictates the society to prefer H^2 over H^1 . C^1 is

⁶ Thus one cannot reject the inconsistency shown in this example by allowing inequality in each weather situation but requiring equality over all weather situations, since each "weather" (or something else) situation need not alternate with another and may be mutually exclusive.

⁷ It may be noted that the requirement of convexity of preferences is trivially met in our simple example of only one economic good. Even if we put the temperature as another axis, the postulated preferences of J and K are still consistent with convexity but not with monotonicity (with respect to temperature). But if we let something else vary, monotonicity can also be satisfied. In fact, what is needed for our proof is a set of four social states having the property depicted in Fig. 1 below. That this is possible under conventional economic assumptions is well known in the debate about compensation.

preferred to H^2 by both individuals. C^2 is again preferred to C^1 by PIEDJ. But both individuals are worse off at C^2 than at H^1 . This shows that PIEDJ is inconsistent with WPP even with the domain of social choice restricted to an exchange economy satisfying conventional economic assumptions. Q. E. D.⁸

In fact, not just egalitarian distributional judgments but all anonymous non-cardinalistic distributional judgments (NCDJ) can be shown to be inconsistent with WPP. To show this, we may interpret the movements H^1 to H^2 and C^1 to C^2 in the above example as satisfying whatever NCDJ in question. That this is always possible under fairly general conditions is established in the following proposition which also generalizes the result to any rule (including, but not necessarily confined to, distributional rules) of social choice.

D. The General Necessity of Interpersonal Comparable Cardinal Utilities

If we accept the Pareto Principle, it is necessary to adopt some form of interpersonal comparison of cardinal utilities to obtain a social ordering for cases where individual preferences conflict, unless we confine ourselves to a highly restricted domain of individual preferences, roughly speaking. This is a fairly general result for social choice and includes distributional judgments. This result holds whether we are dealing with a fixed set (single or intra-profile) of individual preferences or with alternative sets (multi-profile or inter-profile) of individual preferences. Moreover, this result holds even

⁸ It has been suggested that, if individual preferences over the four alternatives are as outlined in the proof, the two individuals should be able to negotiate a mutually beneficial (in terms of ex-ante expected utility) contract to ensure that H^2 and C^2 will be avoided even if chosen by society to begin with. There are several reasons that may make this consideration inoperative. First, transaction costs may be prohibitive such that once H^2 or C^2 is chosen, negotiation to reach C^1 or H^1 may be infeasible. Secondly, the two situations H and C may be mutually exclusive (see footnote 6 above). If either of the two individuals is not an expected utility maximizer, H^2 or C^2 may not be avoided even in the absence of transaction costs. Thirdly, it may be the case that, for a *particular* choice, only one of the two situations (H and C) is relevant, e. g. the other one is infeasible. No negotiation may then be possible to ensure the avoidance of H^2 or C^2 . The other hypothetical situation (and the corresponding social state C^1 or H^1) cannot be rejected as irrelevant if the social choice rule is meant to be generally applicable (i. e. to more than one specific situation).

if we allow some (but not all; this account for the “roughly speaking” part of the opening sentence of this paragraph) non-preference characteristics or objective indicators of social states to affect social rankings (referred to as anti-individualism by Kemp and Ng, 1977, 1982, and as non-neutrality by others). To establish this result, let us introduce some more notations and definitions.

Let the number of individuals be n and the number of aspects over which social states may differ from each other be m . These m aspects may include the amount of r private goods consumed by the n individuals (nr aspects together), the amount of q public goods, and any other number of non-economic aspects including political arrangements, states of nature, etc. Let x_i denote the value or quality of aspect i in the social state x ; and x is the short-hand way of writing (x_1, \dots, x_m) . Let $xO^i y$ denote the ordering or ranking of x and y by individual i . Note that $xO^i y$ stands for either one of: $xP^i y$, $xI^i y$, and $yP^i x$. Similarly, let xOy be the social ranking.

A *Non-Cardinalistic Ranking Rule (NCR)* is a rule which, for any two social states x and y , states the social ranking xOy based on $xO^i y$, $i = 1, \dots, n$, and/or the values of $x_1, y_1, x_2, y_2, \dots, x_s, y_s$, where $s < m$ and $1, \dots, s$ need not be the first s variables in $1, \dots, m$.

It is called non-cardinalistic because, as far as individual preferences are concerned, it uses only information regarding individual orderings but not regarding individual cardinal utilities (differences and/or levels)⁹. Non-preference characteristics of social states are permitted to be used in deciding the social ranking. However, for it to really be a ranking *rule* (in the sense of a general rule instead of a specific decision), we impose the requirements $s < m$. If $s = m$, all m aspects of the two social states have to be specified (in addition to the n individual rankings) before a social ranking is made. This is hardly a *rule*. For all ranking rules satisfying neutrality, none of the m objective characteristics is admissible. Thus, by allowing $s < m$ characteristics to be admissible, we are already making a

⁹ It may be thought that NCR is a misnomer as a ranking rule based on interpersonal comparison of utility levels such as the Rawlsian maximin rule need not involve cardinal utilities as interpersonal comparison of utility differences (unit comparability) does. However, Ng (1982) shows that level comparability implies some form of unit comparability under very general conditions. It may also be noted that NCR subsumes an element of independence which is, however, compelling due to the mutually exclusive nature of social states each of which is an exhaustive specification of all relevant details, see Ng (1979, p. 144).

great concession. In other words, we are relaxing $s=0$ to $s < m$. A ranking rule may thus specify, for example, that if an equal number of individuals prefer x to y and y to x , the social state with a more equal distribution (of some objective factors such as economic goods) is to be socially preferred. Or some other objective specifications (with respect to say public goods, weather, political factors, etc.) may be made.

Consider now some reasonable conditions.

Anonymity: Each individual should be treated anonymously in the ranking rule.

Note that the requirement of Anonymity is very weak due to the allowance for the use of objective indicators in social ranking. Thus, giving more weight to the preference of say a certain poor (or handicapped) person J over the preference of a certain rich person K does not violate our requirement of Anonymity here. It is only failure to give the same higher weight to Mr. K , if he is similiary poor (or handicapped) that violates Anonymity. (More on the flexible interpretation of Anonymity below).

Sufficiently Wide Domain (SWD): The domain of social choice is not so severely restricted as to rule out cases as in Example 1 below.

Note that if we assume Unrestricted Domain as usually done in proving impossibility theorems in social choice, we necessarily have SWD. Moreover, even if we adopt conventional economic assumptions of self-interested individuals who prefer to have more of their own consumption bundles with convexity of preferences, we can still have SWD, as Example 1 satisfies all these assumptions. In other words, we need assumptions more restrictive than the conventional economic assumptions such that the domain of social choice is reduced to an extent violating SWD before we can use any Non-Cardinalistic Ranking Rule without violating WPP.

Example 1: This example is the one used in the proof of Proposition 3 but generalized to cover any NCRR instead of just PIEDJ. For cross reference with the above example, we will still denote our four social states as H^1 , H^2 , C^1 , and C^2 , but they need not necessarily be exactly defined as above. (If the NCRR is not PIEDJ, we may not wish to have equal distribution for H^2 and C^2).

Consider two social states H^1 and H^2 over which some individuals differ strongly in their preferences. In the case of a

two-person society, let $H^1P^JH^2$ and $H^2P^KH^1$. (With more individuals, we may either (i) divide them into two equal groups J and K , holding any odd individual left indifferent; or (ii) hold all individuals other than Jan and Kelvin indifferent and work with the strong version of the Pareto Principle). The Pareto Principle cannot thus dictate social ranking of H^1 and H^2 . Suppose a particular anonymous NCRR (examples are PIEDJ and the Majority Rule based only on individual rankings instead of cardinal intensities of preferences) is used to dictate the social ranking H^2RH^1 . (If the reverse ranking is made, we will just interchange the names of H^1 and H^2 .) Consider another social state C^1 which is Pareto superior to H^2 . Compare yet another social state C^2 and C^1 where $C^1P^KC^2$ and $C^2P^JC^1$ and where the movement from C^1 to C^2 satisfies the same anonymous NCRR that dictates H^2RH^1 . So we must also have C^2RC^1 . This is possible since C^1 and C^2 may differ from H^1 and H^2 in some aspect(s) not included in the s aspects covered by the particular NCRR (see the specific example in the proof of Proposition 3 above) and since the social ranking rule must be anonymous. For example, if the NCRR dictates H^2IH^1 because and simply because $H^1P^JH^2$ and $H^2P^KH^1$, it must also dictate C^2IC^1 from anonymity because $C^1P^KC^2$ and $C^2P^JC^1$. On the other hand, if the NCRR dictates H^2RH^1 not on (or not only on) individual preferences but (also) on something other than individual preferences, we can always select C^1 and C^2 such that C^2RC^1 according to that "something" and hence C^2RC^1 according to the same NCRR. It may be thought that this may not be possible if the NCRR is made sufficiently specific. For example, in the example of Proposition 3, if instead of PIEDJ, the NCRR specifies that the society should prefer equal distribution if the weather is hot and unequal distribution if it is cold, we no longer have C^2RC^1 . However, if such is the case, we may simply select two other social states (instead of C^1 and C^2) that differ from H^1 and H^2 not in weather but in other respect such that our requirements here are met. Since we require that $s < m$, this is always possible if individual preferences are sufficiently diverse. Thus the minimum domain of choice sufficient for our purpose here depends on how specific the NCRR is. (Roughly speaking, the smaller is s relative to m , the more likely that SWD will prevail.)

A similar point arises with respect to the interpretation of Anonymity. If we do not require Anonymity to rule out such things as racial discrimination, then our requirement of SWD

may have to be rather demanding. For example, a NCRR may specify that the society should have xPy if the black J prefers x to y and the white K prefers y to x . If this is accepted as not violating Anonymity due to the qualifying objectives “black” and “white”, as in our previous example of “poor” and “rich”, then our requirements of SWD may have to be very demanding. We would then have to interpret C^1 and C^2 as referring to the hypothetical social situation where the black J becomes white and the white K becomes black. Though this is conceivable, it can be correctly dismissed as practically irrelevant. However, though one may wish to compromise on Anonymity due to such circumstantial factors such as poverty, handicaps, etc., one would not want to compromise so completely such that a ranking rule can specify enough details of each individual as to effectively identify him, making Anonymity completely vacuous. Given this understanding, SWD is not too demanding.

To complete the description of Example 1, we require C^2 to be Pareto inferior to H^1 . That this is possible is due to the restriction that the ranking rule is non-cardinalistic, that $s < m$, and to the requirement of SWD. This is illustrated in the utility

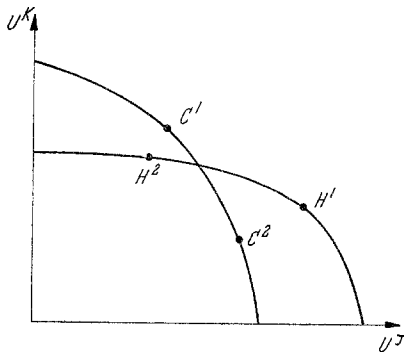


Fig. 1

space of Fig. 1. By construction, $H^1 P^J H^2$, $H^2 P^K H^1$, $C^1 P^J H^2$, $C^1 P^K H^2$, $C^1 P^K C^2$, $C^2 P^J C^1$, and the movements $H^1 \rightarrow H^2$ and $C^1 \rightarrow C^2$ satisfy a particular NCRR. But since this ranking rule is non-cardinalistic by definition, it does not prevent the possibility that J 's gain in utility in the change from H^1 to H^2 is less than the loss in the change from C^1 to C^2 , and *pari passu* for K . Thus, it is quite possible that $H^1 P^J C^2$ and $H^1 P^K C^2$ as illustrated in Fig. 1 and in the example of Proposition 3.

Proposition 4: Given Anonymity and Sufficiently Wide Domain (SWD), there exists no Non-Cardinalistic Ranking Rule (NCRR) which, together with the Pareto Principle, produces a consistent social ordering of the social states.

Proof: For any NCRR, construct Example 1 appropriately. This is possible due to SWD and Anonymity. This NCRR will thus dictate H^2RH^1 and C^2RC^1 , while the Pareto Principle dictates C^1PH^2 . Hence C^2PH^1 from transitivity (a pre-requisite of an ordering). But C^2 is Pareto inferior to H^1 . Q. E. D.

It may be noted that Proposition 4 is implied neither by Arrow's Impossibility Theorem and its many cousins nor by the impossibility propositions of Kemp-Ng (1976) and Parks (1976). It is not implied by Arrow-type theorems as the latter are inter-profile results where *alternative* sets of individual orderings are considered while Proposition 4 can be regarded either as an inter-profile or as an intra-profile result for a given set of individual preferences. Our requirement of SWD is also weaker than Unrestricted Domain usually assumed for Arrow-type theorems. But our Anonymity is stronger than Non-dictatorship. Proposition 4 is not implied by the intra-profile results of Kemp-Ng and Parks as the later results (as well as many inter-profile results) are based on some form (however reasonable they are) of individualism or neutrality; i. e. social ranking should be based on and only on individual preferences (ordinal or cardinal) but not on non-preference characteristics or objective indicators of social states. Here, we allow such non-preference characteristics (e. g. the rich vs. the poor) to be possible factors in the ranking rule. (With neutrality, it is not difficult to obtain intra-profile analogues of inter-profile results and vice versa; see Pollak, 1979; Roberts, 1980 c.) Due to our allowance for non-preference characteristics, we cannot rule out a social ordering based on individual orderings and *complete* ($s=m$) objective specifications of the social states; we rule out only non-cardinalistic social ranking rules, assuming Anonymity, SWD, and the Pareto Principle.

III. Some Related Issues in the Literature

Partly for their own interest, and partly as a way of discussing the implications of the above propositions and how they are violated (at least in spirit) in the literature, let us discuss some related issues in turn.

A. Mishan's Proposed Resolution of the Paradox of Welfare Criteria

It is well known that where the relevant utility possibility curves (UPC) intersect, the use of such welfare criteria as the Kaldor-Hicks compensation test may lead to a contradiction, Mishan (1973, 1976, 1980) proposed to resolve this paradox by relying on purely distributional rankings. While his demonstration that the required third collection of goods (see below) always exists is ingenious, his conclusion is unacceptable because it is based on abstract distributional judgments, and may lead to everyone being very much worse off.

Consider Fig. 2 where the UPC of the two collections of goods Q^1 and Q^2 (non-economic factors are being held constant) intersect such that the comparison of the two social states q^1 and q^2 (each a specific distribution of Q^1 and Q^2 respectively) using compensation tests will lead to a contradiction. Mishan (1973, 1980) argues that if there is another collection of goods Q^3 whose locus in utility space passes through q^1 and q^2 , we shall then be able to compare q^1 and q^2 directly on distributional grounds alone, since q^1 and q^2 differ from each other only due to a different distribution of a single collection of goods (Q^3). By using an ingenious construction involving community-indifference curves, Mishan shows that the required collection of goods Q^3 can, in principle, always be found (assuming divisibility of goods and continuity in preferences). He thus concludes that, "if society is assumed able to rank distributions of a single collection of goods (which has been the traditional assumption), the 'contradictory' collections [i. e. those with intersecting UPC] can be ranked unambiguously albeit only on a distributional scale . . . If society is assumed unable to rank the distributions of a single collection of goods, then 'contradictory' collections cannot be ranked at all" (Mishan, 1973, p. 762). Moreover, Mishan's "findings do not . . . depend on actual identification of the required hypothetical collection of goods [Q^3] . . . Indeed nothing of significance results from knowing the composition of the hypothetical collection. And the purpose of confirming its existence is only to establish the fact that a comparison of 'contradictable' collections can always be reduced to a distributional ranking" (p. 762—763).

In other words, Q^3 need not be identified and q^1 and q^2 ranked as two different distributions of the Q^3 collection of goods. Rather, if society can rank different distributions of a single collection of goods, it should also be able to distributionally rank q^1 on Q^1 (i. e. as a specific distribution of Q^1) and q^2 on Q^2 directly, since q^1 on Q^1 and q^2 on Q^2 are, respectively, exactly the same points in

utility space as q^1 and q^2 on Q^3 . The implication is that, if distributional ranking can be made, it can be made abstractly, i. e. points in utility space can be distributionally ranked irrespective of what social states they represent. I have shown above that such abstract distributional judgments violate, in general, the Weak Pareto Principle. However, since the proof of this result (Proposition 2) relies

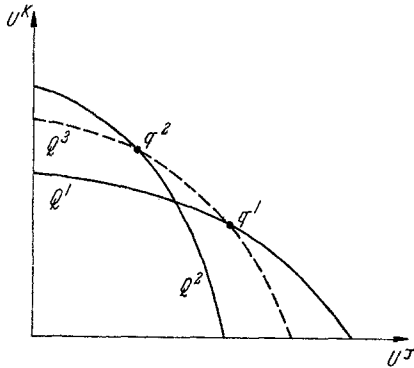


Fig. 2

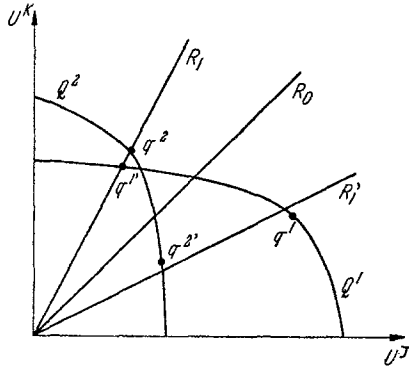


Fig. 3

on “extreme” examples where there exists a social state strongly Pareto superior or inferior to all other social states in the relevant social situation, let us demonstrate the unacceptability of abstract distributional judgments without using “extreme” examples by confining ourselves to downward-sloping UPC. I shall demonstrate this by two different methods.

First, suppose that abstract distributional judgments are made in terms of distributional rays in utility space (Mishan, 1965; 1969, pp. 47—49). In Fig. 3, the ray R_0 may represent the ideal distribu-

tion and the rays R_1 and R_1' two equally desirable (or undesirable) distributions. (Non-linear distributional indifference curve may serve the purpose as well). In general, the further away (proportionately) from the ideal ray R_0 , the less desirable the distribution. This is a natural way of making abstract distributional comparison and reflects the egalitarian ethics. But it can be shown that the acceptance of such distributional comparisons may lead us to a situation where everyone is made tremendously worse off. It may first be noted that movements along a given UPC involves purely distributional changes of a given collection of goods, i. e. no change in production, efficiency, or any other factor is involved. Thus, for a movement along the same UPC, if it is distributionally superior, it must be accepted as a good change over-all as the only change involved is distributional. Thus the movement from q^1 to $q^{1'}$ on the same UPC or collection of goods Q^1 must be accepted as a good change. The movement from $q^{1'}$ on Q^1 to q^2 on Q^2 involves making everyone better off and must be accepted as a good change from WPP. (q^2 is also on the same distributional ray as $q^{1'}$). The movement from q^2 on Q^2 to $q^{2'}$ on Q^2 is again a purely distributional improvement. But at $q^{2'}$ everyone is significantly worse off than at q^1 . Repeated application of such abstract distributional comparisons could lead us to a situation where everyone is equally in hell. The unacceptability is obvious, though equality is achieved.

The intuitive reason for the unacceptability of abstract distributional judgments (ADJ) is not difficult to see. If the problem of distribution were to distribute a *given sum* of utilities to a number of individuals, ADJ would be appropriate. But since distribution is in fact in terms of some objective factors (e. g. goods), and since individual preferences with respect to these objective factors may be different and differ between different social situations, judgments about distributional desirability must take these different preferences or utility possibilities into account. Otherwise, results contrary to individual preferences may be obtained.

We have proved the general inconsistency of ADJ with Weak Pareto Principle; we have shown that a natural method of ADJ (by distributional rays or indifference curves) may lead to a strongly Pareto-inferior situation; now let us show that a reasonable method of making distributional judgments cannot be abstract, i. e. it must depend on specific social states and the utility possibilities of relevant social situations (the second part comes from the fact that it cannot be non-individualistic).

Suppose we all agree on a specific individualistic social welfare function (SWF) and know the utility possibilities of all social states.

Then for movements along a \cup PC (which involves only distributional changes), we must or at least may agree that a movement to a higher social welfare contour is a distributional improvement. Then in Fig. 4, q^1 will be judged the ideal distribution of the Q^1 collection of goods, since it touches the highest contour. Similarly, $q^{2'}$ is judged the ideal distribution of Q^2 , and q^2 a non-ideal distribution of Q^2 . However, when q^1 and q^2 are ranked as different

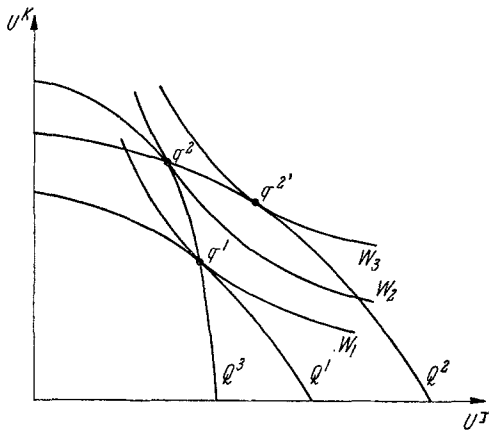


Fig. 4

distributions of the same Q^3 collection, q^2 is ranked a better distribution than q^1 . Thus the same point in utility space (q^1) may be ranked as an ideal distribution if it results from a certain social state of a certain social situation (Q_1) and ranked as an inferior distribution in some other social situation (Q_3). It is clear that the distributional judgments involved are not abstract.

Incidentally, the above argument also shows that, despite Mishan's ingenious demonstration of the existence of the third collection of goods Q^3 whose UPC passes through q^1 and q^2 , it cannot be concluded that q^1 on Q^1 and q^2 on Q^2 can be reduced to a purely distributional ranking. In Fig. 5, q^1 is an ideal distribution of Q^1 and q^2 a non-ideal distribution of Q^2 , but q^2 is on a higher welfare contour than q^1 . Mishan's proposed resolution of the paradox of welfare criteria by relying on purely distributional ranking therefore fails. (It is true that if we have a specific well defined SWF and know all the utility possibilities, we do not need a welfare criterion. But these assumptions are only to clarify what sort of distributional judgments may be deemed reasonable. For the use-

fulness of the Little criterion when specific correspondance in utility space of social states is not known, see Ng, 1979, pp. 68—72.)

B. Sen's Weak Equity Axiom

Let us now consider the Weak (?) Equity Axiom of Sen (1973, p. 18) which is neither completely non-individualistic nor completely abstract. (It relies in fact on interpersonal comparison of cardinal utility levels). However, its individualistic and non-abstractness content is not strong enough to free itself from the objection in the spirit of the above argument, as will be shown presently.

“The Weak Equity Axiom: Let person i have a lower level of welfare than person j for each level of individual income. Then in distributing a given total income among n individuals including i and j , the optimal solution must give i a higher level of income than j ” (Sen, 1973, p. 18)¹⁰.

As stated, the Weak Equity Axiom violates the Weak Pareto Principle as illustrated in Fig. 6 where the given amount of total income OO' is to be distributed to the two individuals i, j with respective marginal utility of income curves MU^i and MU^j (j 's income Y^j being measured leftward from O'). Assume that $U^i < U^j$ for all level of $Y^i = Y^j$. Since MU^i cuts the horizontal axis at C before the equal distribution point E while MU^j is positive throughout, distribution to the right of the point C makes both persons worse off. But the Weak Equity Axioms requires us to go beyond (to the right of) E .

It may be argued that Sen was implicitly assuming positive MU curves and hence a situation like Fig. 6 cannot arise. However, within the confine of positive MU curves (and the associated cardinal measurability and comparability of utilities), we can have a case where MU^i is the dotted curve. By making the dotted curve as close to the origin as we like after, say, the point C , we can reject distribution beyond the point C and *a fortiori* beyond the point E for any finite trade-off between MU^i and MU^j in our SWF. (I refrain from arguing with those who go along with Rawls in accepting an infinite trade-off. But I cannot resist citing Harsanyi's persuasive example that the Rawls principle of maximin will dictate the giving of the only doze of antibiotics to a terminal cancer victim instead of a basically healthy person, both suffering from pneu-

¹⁰ Sen uses the Axiom to reject utilitarianism. For conditions where utilitarianism is consistent with the Axiom, see Hammond (1977).

monia, contrary to utilitarian ethics and common sense.) The Weak Equity Axiom, by taking account only of utility levels without taking account of utility differences, does not seem to be ethically acceptable.

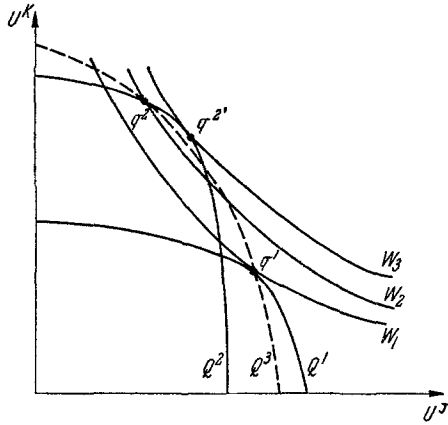


Fig. 5

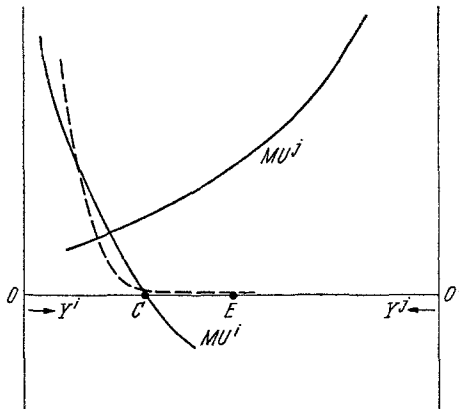


Fig. 6

C. The Will-o'-the-wisp of a Non-cardinalistic Criterion of Equity

While the widely accepted Pareto principle is reasonable and compelling as a sufficient condition for a social improvement, it is insufficient to form the basis of complete social choice since there usually exists a large member of Pareto-undominated social states, some favouring some (group of) individual(s), some favouring others.

An obvious supplement to the Pareto principle is some form of interpersonal comparison of utility. However, since economists are very wary of this, many attempts have been made in search of a criterion of equity that “treats the economic agents symmetrically, is ordinal in nature, and is free of interpersonal comparison of utility” (Pazner and Schmeidler, 1978, p. 672), to supplement but not to over-rule the Pareto principle. From our discussion above, it can be seen that such a search is doomed to failure. Let us list a few representative equity criteria proposed recently and show how they are all inconsistent with the Weak Pareto Principle.

- (1) The Foley (1967), Varian (1974, 1975) Criterion of Envy-Free: A social state (which involves a specific distribution or allocation of goods to individuals) is distributionally equitable if no individual prefers the bundle of goods of anyone else over his own. (See also Kolm, 1972; Schmeidler and Vind, 1972; Feldman and Kirman, 1974.)
- (2) The Varian (1974, 1975, 1976), Pazner and Schmeidler (1978 a) Criterion of (Full) Income Equality: A social state is equitable if, at the efficiency prices supporting the allocation of goods (including leisure), the value of each person’s bundle is equal.
- (3) The Daniel (1975) Criterion of Balanced-Envy: A social state is equitable or just if it is “balanced” with respect to envy. A person is said to envy another if he prefers the bundle of the latter. If the number of people who envy a person is equal to the number of people that he envies, then he is said to be balanced (with respect to envy). A social state is said to be balanced if everyone is balanced.
- (4) The Pazner-Schmeidler (1978 b) Criterion of Egalitarian Edivalence: A social state is said to be egalitarian-equivalent if there exist a commodity bundle (the same for each person) that is considered by each person to be indifferent to the bundle that he actually gets. (For the related concept of fair-equivalence, see Pazner 1977, p. 463).

In the recent literature on the theory of fairness or equity, it is well-known that an “equitable” or envy-free distribution may not exist in a production economy (Pazner and Schmeidler, 1974; Varian, 1974; Archibald and Donaldson, 1979; etc.). This casts serious doubts on the acceptability of envy-free as a criterion of equity. However, no one seems to question its acceptability in a pure exchange economy where a competitive equilibrium with

identical initial endowments for all persons is always fair (Pareto efficient and envy-free) under the conventional economic assumptions (Varian, 1974, Theorem 2.2)¹¹.

While the few criteria listed above all possess certain attractive features, it can be shown that they all violate the Weak Pareto Principle. This can be seen by considering the example of four social states H^1 , H^2 , C^1 , and C^2 used in the proof of Proposition 3 above (illustrated in the utility space of Fig. 1). Since there is only one economic good, an equal distribution of this good meets all the equity criteria listed above and other similar ones. Then, according to any of these equity criteria, H^2 , being the most equitable distribution in the relevant social situation, should be socially preferable to the inequitable distribution H^1 . (H^1 and H^2 differ only with respect to the distribution of the only economic good.) Similarly, C^2 should be socially preferable to C^1 . On the other hand, the change from H^2 to C^1 makes all individuals better off. Thus we must go from H^1 to H^2 , to C^1 , to C^2 . But everyone is worse off in C^2 than in H^1 . All the above equity criteria are thus inconsistent with the Weak Pareto Principle.

D. Some Related Impossibility Results: The Impossibility of a Paretian X

Some impossibility results in the literature may be interpreted as specific examples of the impossibility of non-cardinalism. One example is the well-known Sen's theorem on the impossibility of a Paretian liberal (Sen, 1970, 1976). Liberalism is interpreted to require that, for each individual, there is at least one pair of alternatives (say sleeping on his back or his belly) such that his preference is decisive irrespective of the preferences of all other individuals. Then by letting some other individuals to be sufficiently nose-y to have strong preferences regarding other people's sleeping position, violation of the weak Pareto principle can be demonstrated. This is so since the individual concerned may only prefer sleeping on his back mildly while some other individuals prefer him sleeping on his belly strongly. Some intermediate alternatives can then be selected to demonstrate Pareto inferiority if the mild preference of the individual concerned is decisive. This does not mean that if we accept the Pareto principle we have to give up liberalism

¹¹ However, starting from an "equitable" (envy-free) but not identical initial endowment, competitive trading need not preserve equity in the sense of envy-free, see Feldman and Kirman (1974).

(see Ng, 1971). One may argue that the violation of liberalism to meet the Pareto principle in the short term will lead to undesirable effects in the long term (through attitude formation, etc.). But how can we be reasonably certain that the gain of sticking to liberalism will be sufficiently large in the long term such that a Pareto inferior situation will not result (for the long run). If some individuals gain and some lose in the long term, a situation similar to Fig. 1 may still be constructed for the long-term result unless the gain outweighs the loss. Thus we can only be reasonably confident that liberalism is consistent with the Pareto principle in the long term by estimating that the long-term gain in utilities outweighs the loss, i. e. by making interpersonal comparison of cardinal utilities.

If we select certain principle without regard to its implication on individual (short and long-term) utilities, then it is quite possible that it may be inconsistent with the Pareto principle. Thus, one can establish in general the impossibility of a Paretian X where X is any non-cardinalist anonymous principle. At the risk of repetition, it must be said that this does not mean that a Paretian has to give up all other principles. But it does mean that any other principle must be selected in accordance to its conduciveness to gain and loss in terms of cardinal utilities. For example, the principle of no pre-marital sex was probably more conducive to gain than loss at a time when knowledge regarding contraception and venereal diseases was deficient. Nowadays, sticking to such a principle probably results in more harm than gain. (These are subjective judgements of fact, on which see Ng, 1972, 1979, Appendix 1A). If so, Pareto inferiority can easily be constructed using examples such as Fig. 1. But to know whether a certain principle is or is not consistent with the Pareto principle, one has to compare interpersonal gain and loss in utilities.

After writing the first draft of this paper, I received the manuscript of Camacho (forthcoming) who also argues for the necessity of cardinal utilities but using a sequential framework. (The method of cardinalization used thus either involves the assumption of intertemporal independent utilities or is similar to the expected utility hypothesis)¹².

¹² See also some recent papers by Suzumura, e. g. Suzumura (1981 a) shows that the Goldman-Sussangkarn (1978) rule of "fair" social choice does not always satisfy the Pareto principle, and Suzumura (1981 b) shows that there exists no generalized Collective Choice Rule (which bases social choice on the extended preference orderings of individuals) satisfying the fairness extension condition and the superset axiom of choice consistency.

IV. Concluding Remarks

The rationale of Proposition 4 (Necessity of cardinalism) is not difficult to see. A non-cardinalistic ranking rule ignores the intensity of preferences. Whatever the non-preference specification of the ranking rule in question, one can always select a number of social states (e. g. H^1 , H^2 , C^1 , C^2 in Fig. 1) such that the rule and the Pareto Principle will yield a cyclic social (strict) preference (due to the requirements of $s < m$, SWD, and Anonymity). It may be thought that, while a formal inconsistency is present, one may choose a “good” ranking rule such that no inconsistency may arise in practice. This will be so if the rule is chosen such that Sufficiently Wide Domain does not prevail. This is quite possible for some specific restricted domain of social choice but not so in general. Moreover, how a “good” rule can be made has in fact to be decided precisely by interpersonal comparison of cardinal utilities. To illuminate this point, consider the following specific (component of a) rule: Medical care should be distributed equally. As the example of Proposition 3 illustrates, such rules are inconsistent with the Pareto principle even if medical care is the only economic good. For one thing, it would be silly to provide medical care equally to the healthy and to the sick. Suppose it is improved to read: Medical care should be provided equally to all sick persons. But what about different kinds and different degrees of sickness? It may be a good practical rule to give priority to a patient with a bee-sting over a patient with an ant-bite. But such rules can be generally consistent with the Pareto Principle only because they are made on sensible interpersonal comparison of cardinal utilities — a person with a bee-sting is likely to suffer more disutilities than one with an ant-bite. Even here, exceptions are possible. What if a particular person is sensitive to ant-bites such that he suffers enormously without treatment. Should the general rule of the priority of bee-stings be over-riden in this case? Yes, or perhaps one wants to include this “exception” into the rule as well. But isn’t “suffering enormously in comparison to a bee-bite for a normal person” an instance of interpersonal comparison of cardinal utility? Moreover, no matter how detailed we make our rule to be, there are bound to be further exceptions unless we are confined to a fairly restricted domain.

It is true that we (the society, a parent, or an individual) cannot make a detailed interpersonal comparison for every specific decision. Some rules, routines, etc. do generally serve good purposes (e. g. contributing to the maximization of a Paretian SWF). But for such rules to be good generally, they have to be based ultimately on

interpersonal comparison of utility. And the reason we do not make a detailed comparison every time is mainly because of the practical costs (time, trouble, informational) of doing so.

Most practical social decisions (as made by a parent, a head of department, or a prime minister) are at least partly based on some interpersonal comparison of cardinal utility or on rules that are themselves based ultimately on interpersonal comparison. Despite this apparent fact and despite the repeated demonstration in the social choice literature of the difficulty of ordinalism, economists in general and social choice theorists in particular keep on operating within the confines of ordinalism. This is due partly to the difficulties of adopting some acceptable scheme of interpersonal comparison and partly due to the legacy of the methodological mistake of regarding interpersonal comparisons of utility as value judgments and hence as scientifically meaningless. (Influenced mainly by Robbins' influential writings of 1932 and 1938). I have argued elsewhere (Ng, 1972, 1979, Appendix IA) that interpersonal comparisons of utility are not value judgments but (possibly subjective) judgments of fact. The interpersonal judgment that *J* will be made much happier than *K* is made worse off by changing from *x* to *y* does not imply that *y* should be chosen over *x*. This is so only if we accept the Benthamite value judgment that we should maximize the sum of individual utilities. If we accept the amazingly popular value judgment of maximizing the utility of the worst-off individual, we have to choose *x* over *y* if *K* is the worst-off. Moreover, I have also argued elsewhere (Ng, 1975) that a sensible scheme of interpersonal comparison is available and have suggested ways of overcoming some practical difficulties of actual interpersonal comparison. It is time that more effort is made in this direction, as effectively appealed by Mueller (1979, pp. 181—183).

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